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ABSTRACT

Structured alliances among universities and K-12 schools have been suggested as one route through which to renew both the education of young people in American schools and to recreate and reconceptualize what it means to educate prospective teachers. This summary of a panel presentation discusses the development of various high school/university partnerships in the context of high school-based science teacher education programs. (CCM)

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# UNIVERSITY-HIGH SCHOOL PARTNERSHIPS FOR SCIENCE EDUCATION: MULTIPLE PERSPECTIVES

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Science education has enjoyed a renewed national emphasis in recent years. The *National Science Education Standards* (National Research Council, 1996), the *Benchmarks for Science Literacy* (American Association for the Advancement of Science, 1993), and *Science for All Americans* (American Association for the Advancement of Science, 1989) have become known not only within the science education community, but also among the general population. The impact those documents have actually had on the classroom practice of science teachers and on the teacher education programs responsible for educating and developing prospective science teachers has been less wide-spread. That lag in the implementation of reformed practice is consistent with Goodlad's (1994) appraisal of the change in teacher education programs across all disciplines.

Structured alliances among universities and K-12 schools have been suggested as one route to renew both the education of young people in America's schools and to re-create and re-conceptualize what it means to educate prospective teachers (Goodlad, 1994; Osguthorpe, Harris, Black, Cutler, & Harris, 1995). These joint endeavors to prepare prospective teachers have been identified by various names and philosophical concepts. Many educators are familiar with the Professional Development Schools which emanated from the work of the Holmes Group (1986). Professional Development Schools were conceptualized as schools where school faculty and administrators and university students and faculty would be involved in the processes of: (1) mutual deliberation on problems with student learning, and their possible solutions; (2) shared teaching in the university and schools; (3) collaborative research on the problems of

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educational practice; and (4) cooperative supervision of prospective teachers and administrators. (p.56)

More recently, Goodlad (1993) coined the term "partner schools" to describe the type of egalitarian relationships that would lead to the reform of teaching and learning in K-12 schools and university-based teacher education programs. Ideally, partner schools would represent "Centers of Pedagogy" (Goodlad, 1994) and would exemplify best practice, create knowledge through collaborative research, assist in the redesign of teacher education, and provide renewal for teachers.

When we think about partnerships in science education, we might initially conjure a picture of school-industry (Carter, Park, & Copolo, 1998) or school-university science (Herwitz & Guerra, 1996) alliances. In the context of science teacher education, however, the concept of a partnership centers on the collaborative relationships that are built among school faculty, students, and administration and university science education faculty and students. The notion of school-university partnerships for the development of prospective and inservice science teachers is supported by the *National Science Education Standards* (National Research Council, 1996). The professional development standards advocated in that document stipulate that teachers of science engage in discourse with their peers and work collaboratively with university science and science education faculty. The products of such interactions would, theoretically, be enhanced field experiences for prospective science teachers and richer professional development opportunities for inservice teachers. To specifically guide the process of teacher education in the profession, the National Science Teacher's association has begun the development of a set of published "Standards for the Education of Science Teachers." Included among the set of ten standards is that of "professional practice." A "professional" science teacher, according to the NCSTA standards, "participates with others in science education to develop opportunities for continuous learning as members of a professional education community" and "takes responsibility for new science teachers, teacher interns and practicum students and works with them collegially to facilitate their growth and entry into the profession." Those goals can be

effectively met through teachers' participation in partnerships with university faculty and teacher education programs.

Workable school-university partnerships depend on a number of factors. The most important aspect in initiating such partnerships is developing a means of effective communication based on a shared sense of equity and trust between and among all the partners. Since K-12 schools and universities often consider themselves to be attacking different goals, partnerships must identify and address "overlapping self-interests" (Goodlad, 1994). Frequently, frustration over an inability to realize desired outcomes sets the stage for the development of closer ties between university teacher education programs and area schools. Harris and Harris (1995) described the launch of their partnership with an elementary school to be the result of three issues: (a) dissatisfaction with their teacher preparation program and public school function, (b) a need for leadership at all levels, and (c) a need for school and university faculty who were willing to embrace new models concerning knowledge, teaching, learning, and leadership.

As these cross-community partnerships develop, what do the emerging relationships look like and how successful are they? Few of the descriptions of partnerships in the current literature involve high school-university relationships. The lack of reports derived from high school settings may reflect the difficulty universities have establishing collaborative relationships with high school faculties. Discipline-specific curricular demands within university programs and scheduling issues at the high schools could hinder the potential to develop programs requiring prospective high school teachers to consistently be on a public school campus for any significant length of time. Those difficulties may be further enhanced when the partnerships involve science teachers. The dearth of qualified science education graduates has forced many high school administrators to hire science-trained professionals from business and industry who desire to become teachers, but do not have a background in education. The lack of understanding these teachers have concerning the scope, sequence, and purpose of teacher education could pose a significant, but not insurmountable, barrier to their full participation in the development and

implementation of programs designed to prepare prospective teachers to enter the teaching profession. The goal of this panel presentation was to provide descriptions of and dialoguing about the development of various school/University partnerships in the context of high school-based science teacher education programs.

## The Perspectives

The panel consisted of three members of the science education community who contributed a range of viewpoints about the details of school/university partnerships within the context of secondary school science teacher education programs. Each of those perspectives will be summarized in the text that follows.

### A Whole-School Partnership

A partnership between Cary High School (CHS) and NC State University was formalized in May 1996. This partnership grew out of existing connections between a cadre of mentor teachers who were participants in the Model Clinical Teacher Program and a CHS teacher who was employed at NC State as clinical faculty. The partnership was initiated by the CHS faculty and was quickly embraced by the NC State faculty. During May and June 1996, several day-long retreats were held to allow both faculties to work together in forming a framework of what this new association would look like; from this came a mission and vision statement, goals and objectives. By Fall 1996 subcommittees were in place to implement specific innovative changes in the faculty, student and administrative programs/processes at the CHS and NC State sites; student teachers from NC State were placed at CHS under the partnership arrangement for the first time in Fall 1997.

The positive responses generated by the CHS/NC State partnership and an interest in school partnerships from the UNC University System encouraged NC State to expand the partnership initiative to include the Wake County School System, where Cary High School is located, and to add two additional school systems, Franklin County and Johnston County. These

three school systems and NC State established Triangle East Partners in Education (TEPIE) in Spring 1997.

Innovations in the Student Teaching Program at CHS

The formation of the CHS/NC State partnership allowed the two faculties to address some specific changes in the preservice program for students at NC State in science education and mathematics education for implementation in Fall Semester 1997. Several of these innovations were under consideration by the NC State faculty in the Department of Mathematics, Science and Technology Education at the time the partnership with CHS was established; the formation of the partnership allowed for the implementation of these changes more quickly and on a large scale.

The traditional program for senior students at NC State in preservice education includes a Professional Semester that consists of seven and one-half weeks on campus enrolled in "materials and methods of teaching" courses followed by 10 weeks of full-time student teaching. The on-campus courses are scheduled from 8:00 a.m. until 12:30 p.m. Week 3 and Week 6 of the Professional Semester each contain two days of on-site observations at the schools where the students will do their full-time student teaching. Usually the first observation days (in Week 3) is the first time that the student teachers have met their on-site cooperating teachers.

Due to the CHS/NC State partnership, the role of the student teacher during the Professional Semester has become longer and more complex; to denote these expanded responsibilities, the "partnership" student teachers are referred to as Interns. The partnership allowed the faculties at CHS and NC State to make several cooperative changes in the preservice Professional Semester.

1. Involvement of Interns in the Teacher Workdays - Public school teachers are typically required to attend a series of work days prior to the beginning of classes in the public school. Consequently the Interns had the opportunity to meet with their Cooperating Teachers (CT) before their involvement in the public school classes and work with them in the planning of

classes for the fall semester. This required the Interns to return to NC state a week before their on-campus methods and materials classes began.

2. Interns Attend Opening Day in the Public Schools - The first day of the Professional Semester coincided with the opening day of the public schools. The Interns were required to spend Opening Day with their CT at the school site.

3. Interns Become Co-Teachers of 6th Period Class From the Beginning of the Professional Semester - Since the on-campus methods and materials classes are completed by 12:30 each day, the Interns return to CHS each day to participate in their CT's 6th period class; this is the last class of the day at CHS and run from approximately 1:30 to 2: 20.

CHS Faculty Response to Partnership Innovations

Eleven teachers at CHS served as Cooperating Teachers (CT) for the eleven NC State Interns in mathematics and science during Fall 1997. All of these teachers had previous experience as CTs and had participated in the traditional student teaching experience with other NC State students. Four of these teachers had been active participants in the planning of the CHS/NC State partnership; the others had minimal involvement. During and after the 1997 Professional Semesters, anticdotal information was gather from these teachers on their response to the partnership innovations. Additionally the CTs responded to a written survey given to them by their CHS faculty coordinator; the survey asked the CTs to comment on specific changes in the Professional Semester resulting from the CHS/NC State partnership. These date are reported below for each of the three selected partnership innovations.

Involvement in Teacher Workdays

All of the CTs thought this change in the program worked well. It provided a time for CTs and Interns to meet without the pressure of having classes to conduct. There was the opportunity for joint planning, making it easier for the Interns to visualize the role they were going to play in the classroom. This early planning made the CT and the Intern partners and co-teachers. One of the most important aspects was that the Interns saw themselves being recognized as professional teachers and as active members of the CHS faculty. It was difficult to

distinguish between the Interns and other teachers who were new to the school. The Interns became part of the teaching/planning process, rather than apart from that process.

Attending Opening Day

This was the most acclaimed innovation for the partnership. Every CT valued this experienced for providing the Interns with the "before" picture for their internship. As one teacher commented, "I thought it was extremely beneficial for [the interns] to see how the year starts and then transforms." The Interns had a deeper appreciation of the changes in the high school students through the semester. Interns also had the opportunity to observe the different techniques used by teachers in establishing protocol on opening day, especially the importance of introducing the students to the subject area in a fun, interesting way rather than simply giving rules and establishing structures.

Co-teaching 6th Period

Of the three innovations this one received the most mixed reviews. Two of the 11 CTs "...didn't think it was particularly beneficial for [the Interns]." Five CTs specifically remarked on the positive value of the 6th period experience. Most of the Interns had to return to the university immediately after 6th period ended in order to carry out assignments from their on-campus classes. The discrepancy among the CTs views of the experience may be due to the expectation of some CTs that the intern would remain after class every day to plan for the next class. Also the relationship between the Interns and their CTs developed differently, some becoming stronger that others. The overall view toward the 6th period experience was positive; one teacher commented, "[The Interns] seemed so adjusted and ready to assume their teaching responsibilities because the already knew student names and general info. By the time they begin teaching, that (the teaching) was all they had to worry about." In one 6th period class students were surprised when the Intern left at the end of the semester; they thought she was a co-teacher.

Figure 1. Teacher Intern Outcomes of the Cary Project.

By participating in Teacher Planning Week, interns:

- were welcomed and viewed as part of whole school faculty
- were recognized as partners in the Partnership
- became acquainted with the physical layout & procedures of the school
- assisted in planning for courses they would teach
- knew prerequisite lessons of classes before beginning internship
- were able to link on-campus activities to planned lessons
- established a professional relationship with cooperating teacher
- experienced being a "real" teacher

By attending Opening Day, interns:

- saw how teachers introduced science to their students
- observed the Opening Day routine
- became acquainted with how management plans were developed with students
- met and were introduced to all their classes
- assisted the cooperating teachers in teaching the classes
- discovered the paper work required start the year

By assisting and teaching 6th period class throughout the semester, interns:

- observed the development of the class/teacher rapport
- established earlier contact with the students making it easier to teach the class full-time
- learned names and the patterns for the first class they would pick up
- added additional classes to their schedule sooner that other interns
- related incidents from class to members of the Methods course
- set the context for some Methods activities
- helped Methods students understand the application of class material

Adding on-campus time for reflection and portfolio development enabled the interns to:

- reflect on the total internship experience
- have extended discussion and analysis with fellow interns
- develop their portfolios through their reflections
- express the need for additional specific "methods" for this time
- find direct relationship between class material & their experiences
- celebrate their accomplishments through their portfolio presentations

All three of these partnership innovations were used again with the Fall 1998 Interns. With the faculty at CHS more familiar with the program, the CTs made greater use of these opportunities. The NC State faculty examined class assignments and reduce the requirements that would call for the Intern to specifically return to campus. Table 1 lists some outcomes for the Teacher Interns who participated in this project. Data on the Fall 1998 experience are still being evaluated. Closer counseling between the CTs, the Interns and the University Supervisors helped to facilitate the success of these and other changes in the CHS / NC State Partnership preservice preparation of teachers.

Smaller Pieces: Departmental Alliances

The innovations implemented in the CHS/University partnership allowed progress toward providing university interns with more, and longer, in-school experiences during the professional semester. The "Methods" class, however, was still held on the University campus; students did not have regular opportunities to interact with school students while learning pedagogical strategies and concepts. When the interns did reach the internship phase of the semester, they were often scattered throughout the large county-wide school district, having little access to the university supervisor or their peers. The prospect of creating a "center" for the development of prospective science teachers provided the incentive needed to promote the alliance between a high school science department and the university faculty member.

The Partnership Site

Avery High School (pseudonym), a large high school in the southeastern United States, was chosen as the site for the development of our science department-university partnership. Several factors contributed to the selection of AHS as the partnership site. Location was a primary concern. University students and faculty needed to be able to access the site with a minimum of travel time; AHS was a fifteen minute drive from the university. The size of the partner school and the number of available science faculty were also considerations as the development of a potential center for science teacher education would require a large faculty. AHS had a science faculty of sufficient number (18) to support a sizable cadre of prospective

science teachers engaging in school-based field experiences. AHS was also an attractive site for the partnership because the teachers had a significant need and potential for professional development. The school had experienced a recurrent turn-over in science teachers, especially among not-yet-licensed first and second year teachers. The teachers' attempts to continue in self-directed professional development and their participation in state and national organizations were very limited. Among the faculty of 18 teachers, only two had completed a program that would educate them to mentor unlicensed science teachers in the school. Few of the teachers regularly volunteered to mentor teacher interns. Finally, the university faculty member was impressed with the need the school faculty had for the development of a positive, professional support system. AHS had experienced a "split" when the student population outgrew the available resources at the site. Ninth grade students were moved to a newly opened middle school for two years and then to a converted industrial complex during the following academic year. The faculty teaching courses targeted for ninth grade students moved from site-to-site with the students. Those faculty had limited opportunities to interact with their departmental peers who remained on the main campus. One of the underlying goals of the partnership was simply to provide a way to get the AHS teachers together in a collegial environment where they could focus on a positive, collaborative purpose.

Getting Started

The idea for the partnership was actually "seeded" during a conversation between the university faculty member and Tim (pseudonym), a chemistry teachers at AHS, about the possibility of implementing a science education "Methods" course on the high school campus. Tim, who had been supervising teacher interns in his classroom at the school, indicated an interest in participating in a more intensive, practical approach to the traditional "Methods" course. The university faculty member's conversations with Tim led to an interview with one of the school's assistant principals; several subsequent meetings were held to negotiate a plan for a project. The STEAM (Science Teacher Education and Mentoring) project, designed to develop

and implement a collaborative professional development community on a high school campus, resulted from those interactions. Several specific goals drove the STEAM project's agenda:

1. To develop and implement an "on-site Methods" course for prospective high school physical science (chemistry, physics, and earth science) teachers.
2. To identify and develop a cadre of teachers who would act as mentors for teaching interns.
3. To provide instructional support for entry year and other nontenured classroom science teachers.
4. To develop a collaborative community for the continuing development of teachers across all levels of professional expertise (i.e. preservice and inservice public school teachers, and university faculty).

In February, 1998, after receiving approval and support from the AHS administration, informational flyers were sent to all the science teachers in the high school and a meeting was conducted at the monthly departmental faculty meeting. Eight teachers volunteered to participate in the project. The teachers represented all the content areas taught by the science department (biology, chemistry, physics, earth science, and physical science). The teaching experience of the participants ranged from 2 to 29 years. Four of the participating teachers had graduated from four-year teacher education programs where they had engaged in traditional methods/student teaching experiences. Four other science teachers had entered the profession through alternative routes, usually earning a degree in a particular science discipline and then working in industrial settings prior to coming to the teaching profession. The project "team" also included a professional facilitator, a research consultant, a university science education faculty member, and two senior-level students from the undergraduate science education program at the university. The director of teacher education at the university attended and participated in the project meetings.

The high school teachers met with the university members of the project team on four occasions during the Spring, 1998 semester. All meetings were held after school in Tim's classroom on the high school campus. The objectives of the four meeting sequence were to

develop a sense of community among the university and high school participants and to begin a dialogue concerning the on-site Methods course that would be held on the high school campus in the following Fall semester. In preparation for the first two meetings, the teachers were asked to read Chapter 4 ("Standards for Professional Development for Teachers of Science") in the *National Science Education Standards*, (NRC, 1996) and the draft (www-based) version of the National Science Teachers association's "Standards for the Education of Teachers of Science." The teachers completed surveys developed by the university faculty member to communicate their responses to the readings. (Teacher time was compensated monetarily through a grant awarded by the university's partnership organization.)

The research consultant, university faculty member, and facilitator met prior to each meeting to examine the data generated from the prior sessions and to set the agenda for the upcoming interactions. The facilitator began each meeting with a clear idea of her goals and implemented the agreed-upon agenda. A summary of the focus of each meeting follows:

Meeting #1: What do you believe to be the primary purpose of an undergraduate level science teacher education program? What roles can inservice teachers play in the process?

Meetings #2 and #3: What roles do the cooperating teacher, teacher intern, and university supervisor play in the development of prospective teachers? What one thing, in your opinion, is of utmost importance in the development of prospective teachers?

Meeting #4: What are the uses of a methods course? What coordination between university and school faculty do you think the development and implementation of a methods course will require?

In addition to the four Spring meetings, the teachers were invited to confer with the university faculty member and the research consultant on two occasions during the ensuing summer months. In those meetings the teachers were encouraged to consider the specific elements that would be included in the Methods class. One of the then-graduated university student participants was hired by the high school and was assigned to work with the Methods

class. The university faculty member and the chemistry teachers collaborated to develop parallel lesson plans that would encompass both the goals for the students in the chemistry class and the teacher interns.

The Methods Course

The Methods course was conducted from mid-August through mid-September in the Fall, 1998, semester. The teacher interns reported to the AHS campus to participate in the "work week" which preceded the first day of school. During that time the interns met with their cooperating teachers, worked with the chemistry teacher to prepare for the instruction that would occur in the chemistry class, and participated in seminars with the university instructors. Preparation for the beginning of the school year included setting up the classroom environment (bulletin boards, seating arrangements, etc.), developing instructional materials and assessments, and mixing reagents and gathering supplies for the laboratory activities. During the seminar sessions the interns began to examine instructional practices (i.e., assessment and discussion techniques) and lesson planning.

The teacher interns participated in the classroom-based Methods course for approximately five weeks. The following schedule was implemented:

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| 11:45 -12:15 | Final preparations and debriefing for the chemistry class agenda |
| 12:20 - 1:15 | Participation in the academic chemistry class |
| 1:30 - 4:00 | Seminar and preparations for the upcoming chemistry classes |

During the chemistry class sessions the TIs made observations and facilitated small group discussions and laboratory activities. Observations, concerns, and suggestions were discussed in the seminar sessions that followed the chemistry class. The seminar sessions were also used to allow the teacher interns to further develop their own skills (discussion techniques, understanding students' conceptions, lesson planning, etc.) and to help the classroom teacher develop quizzes and tests and prepare for the laboratory activities.

Initial reports about the project indicate that the Methods course was well-received by the participating high school students who appeared to enjoy the extra attention afforded them by the

presence of the teacher interns. The university teacher interns, however, had varied opinions about the structure and benefits of the course. Some of the TIs believed that the workload required to integrate preparations for the chemistry class with the demands of the university Methods class was excessive. The classroom teacher, a first year teacher who gave up her planning period each day to participate in the after-chemistry class seminar session, reported that she benefited from the interactions she had with the university instructor and the teacher interns.

Using Inquiry Projects in Partnership Schools

UNCW's Professional Development System is a nationally recognized educational reform effort involving a school of education, ten school systems, and fifty professional development schools in southeastern North Carolina. Drawing heavily on a systems approach, PDS organizers utilized theory and research in organizational reform, professional development of educators, and curricular/instructional supervision to inform the design and implementation of each generation of our collaboration with schools in our region. We related to schools initially in ways described in both Goodlad's model of Partnership Schools (1993) and the Holmes model of the Professional Development School (1986). From that point, we have situated those site-specific partnerships within the context of a system of partnerships. We are now in the third round of contractual agreements with the ten school systems. Those agreements define the roles and responsibilities of each member of the PDS. We say that our professional development system works for us because it is our system we have a shared ownership and we seek to meet our collective goals. The connection of shared ownership and the affirmation of collective goals are likely idiosyncratic and unique to the particular collection of people, programs, and communities in our system. What is applicable more broadly are the guiding tenets we have embraced and refine throughout our partnership efforts.

The UNCW PDS works because of true collaboration through a dynamic process promoting respect, inquiry, and leadership. This process embraces professional culture through valuing a developmental perspective of our people, purposes, and programs and thereby respecting the differing levels of experience and readiness among members of the system. That

developmental view is facilitated through inquiry into our practice; we look closely at what we are doing and pay attention to outcomes, responsively changing our thinking and our practice by looking at the collected data within appropriate contexts. Further, we have learned that it is not enough to have an understanding of developmental process, nor even adopt a habit of inquiry we must also have leaders at each part of our system who share a common vision and take risks to bring that vision to reality. Finally, we have realized and celebrated a lack of closure; we will never be finished because each lesson we learn teaches us new questions. We are resolved to look for progress in our growth, rather than seeking a sense of accomplishment in ending that growth.

Inquiry in Professional Development

There is a clear need for inquiry within the context of professional development efforts (Byrd & McIntyre, 1999). Inquiry can be defined as a search for information and insight through documented collection and analyses of data. Inquiry projects assigned to teacher interns during the

internship experience and inquiry projects conducted by practicing teachers individually and collaboratively with interns and other teachers are showing promise as a means to facilitate thoughtful analysis and change in teacher practice. The inquiry project is seen as a means of documenting and thereby analyzing the decision-making processes inherent in teaching and connecting those decisions to the collection means and sources of the data used to make and evaluate those decisions. Many teachers have stated that they do what they do because they know it works. Inquiry projects require a more thoughtful analysis of exactly what they are doing and how they are deciding that what works. The practice described here is implementation of the Teacher-Directed Classroom Inquiry Project (Rogers, 1998) consisting of planning and reporting guides. The planning guide helps teachers to select an inquiry topic, consider additional information needed to focus on a particular inquiry, choose data sources and means of collection most likely to match inquiry, determine how those data can be analyzed to address the inquiry, and acquire appropriate approval (especially important for our teacher interns). The report guide

leads teachers through the process of stating the inquiry and any appropriate background information; telling the procedure, findings, and conclusions of the project; explaining further implications of the project from the teacher s perspective, and stating references for those who read the report. These inquiry projects are being shared among teacher interns, partnership teachers, and other LEA and university educators to promote discussion of issues associated with UNCW s Professional Development System.

## Summary

The initial efforts to develop partner relationships with the public schools are already bearing fruit with respect to changes in North Carolina State University's teacher education programs. The ongoing dialogues between school and university faculty are also providing opportunities for deeper levels of collaboration than we have experienced in the past. The alliances allow university personnel and school personnel across all levels of authority (classroom teacher, superintendent, university vice chancellor, etc.) to come together for a common purpose--to improve the development of prospective teachers and to help school children be more successful. The CHS/NCSU partnership has provided a small, doable "model" environment to examine the negotiations necessary to bring people with seemingly different agendas together to achieve a collaborative mission. That alliance has already led to changes in the university's teacher education program schedule. The STEAM project is yet another attempt to impact the classrooms of individual teachers and their students while at the same time providing rich, interactive environments in which university teacher interns may actively participate in and professionally reflect upon the work of teaching. The inquiry projects used in the UNCW system provide an opportunity for teacher interns and partnership teachers to engage in activities that allow them to reflect on their beliefs and practices. Those collaborations have been successful in building collegiality and enhancing the professional developments of all the participants.

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